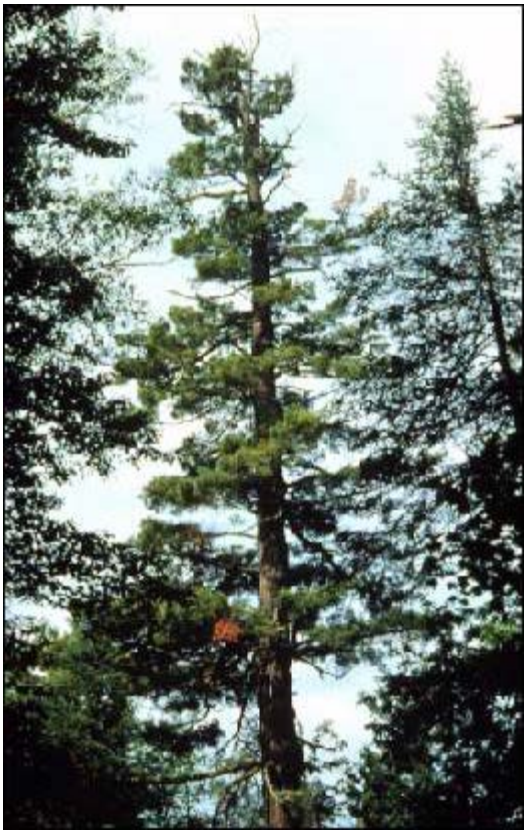
HOW to

Manage Eastern White Pine to Minimize Damage from Blister Rust and White Pine Weevil



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Cover Photo
Minnesota's largest white pine, 112 ft. tall, 173 in. diameter at breast height, approximately 275 years old, Lake Itasca State Park (Photo courtesy of Kathy Ward, North Central Forest Experiment Station).

Introduction

White pine was once a dominant forest species in the north central and northeastern United States. Following logging in the late 1800's and the early part of this century, two major pests, white pine blister rust, *Cronartium ribicola* J.C.Fisch., and white pine weevil, *Pissodes strobi* (Peck), combined to reduce the value of white pine. Blister rust was introduced into North America. The weevil is a native insect whose populations and damage increased greatly in newly established plantations following logging and in stands that originated from natural seeding of abandoned farmland.

These two pests, along with serious deer browsing problems in some areas, resulted in white pine acquiring a reputation as a poor choice with many forest managers. This is unfortunate since white pine has many excellent qualities and is an important component of numerous forest ecosystems.

Growing white pine does require some management effort. Tree mortality from blister rust and damage from weevil attacks should be expected even if the recommended guidelines are followed. However, high quality trees can be grown and damage minimized with planning and a modest amount of effort.

The intensity of both blister rust and weevil varies depending on location. Rust incidence is most severe where late summers are cool and damp. Weevil attacks cause the greatest damage in more northern locations. Weevils are almost non-existent in the southern part of the range of white pine. Therefore, as a rule-of-thumb, both blister rust and weevil problems should be expected in the northern half of Minnesota and Wisconsin, Michigan's Upper Peninsula, and throughout New England. Blister rust incidence is low in Michigan's Lower Peninsula though weevil injury is prevalent there. Even in areas generally considered low risk for blister rust you can find localized problems, therefore the best advice is to ask a Forest Service or state forest pathologist or entomologist for the incidence of both blister rust and weevil in your area.

Symptoms

White Pine Blister Rust

Symptoms vary with different stages of disease development. The most obvious symptom is a red needled branch "flag" (figure 1) caused by a blister rust canker girdling and killing a branch. These cankers can persist for several years before a branch is killed. Branch cankers can be either depressed or somewhat swollen with a definite color contrast between the canker and the greenish bark of younger white pine (figure 2). Older cankers often exude resin. In early spring, orange-yellow, powdery masses of spores are produced on cankers. Cankers may progress along the branch to the main stem of the tree causing symptoms similar to those on branches (figure 3).

Figure 3. Canker on main stem (photo right)

Figure 1. Red-needled branch "flag"

Figure 2. Branch Canker

White Pine Weevil

New weevil attacks become visible in early July when the terminal shoot suddenly wilts. The wilted terminal forms a very characteristic shepherds crook (figure 4). Within a week or two the needles of the current emerging terminal, its laterals and the previous years terminal turn brown-red in color. Weevil larvae, called grubs (figure 5), feed under the bark of the previous years terminal. This feeding injury is significant and kills everything above the injury, thus killing the new terminal as well. Dead terminals remain on trees for years although they are eventually reduced to a stub. Loss of the terminal results in one or more lateral branches taking over dominance of the tree. This leads to a noticeable crook in the main stem or forked stems, which reduces the commercial value of the sawlog and aids in the identification of older attacks for many years. Adult weevils (figure 6), emerge from infested shoots in mid- to late summer. They overwinter in the needle layer, generally beneath the tree they emerged from. Female weevils lay eggs in terminals early the following spring.

Figure 4. "Shepherds Crook" (photo right)

Figure 5. White Pine Weevil larva (*"Grub"*)

Figure 6. White Pine Weevil

Preventive Measures

White Pine Blister Rust

The best silvicultural practice to reduce losses from blister rust is to manage young white pine under an existing overstory. The presence of the overstory reduces moisture formation on the needles necessary for rust infections to occur. **The worst practice is to manage young white pine in small openings, particularly at the bases of slopes and in low areas.** Small is defined as openings with a diameter less than the height of surrounding trees. These openings collect cool air and have abundant dew formation, ideal conditions for rust infections to occur.

The best cultural practice to reduce losses from blister rust is to prune lower branches of young white pine (illustrated in figure 7). Research shows that more than 99 percent of all infections occur within 9 feet of the ground. This fungus requires high moisture levels for initial infections, which occur more frequently near the ground.

Pruning Recommendations

When pruning, do not flush cut. Pruning cuts should be made immediately outside the branch collar.

1. Begin pruning lower branches by age 5 to7. Pruned branches can be left on site.
2. It is **important not to remove too much of the crown.** As a guide, attempt to maintain 2/3 of the tree height in live branches. At no time should branches be pruned from more than ½ the height of the tree.
3. Pruning should be continued to a minimum height of 9 feet. Pruning to 17 feet is ideal.
4. **Aim to prune 100 - 200 trees per acre in natural stands and 350 per acre in pure white pine plantations.** It is not necessary to prune every tree, prune only the most desirable individuals.
5. Trees with blister rust cankers on the main stem or within 4 inches of the main stem cannot be saved, do not waste your time pruning them. **Branches with cankers beyond 4 inches should be removed, no matter where they occur in the crown of the tree (illustrated in figure 8).**

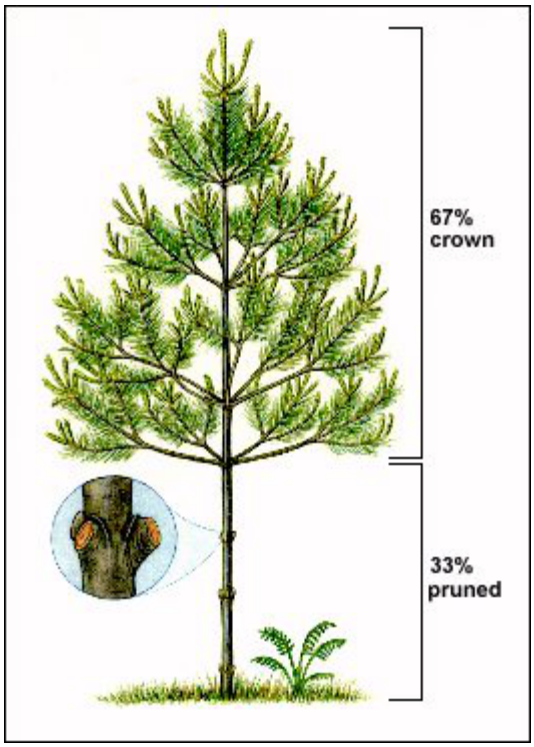


Figure 7. Pruning Recommendations (figure right)

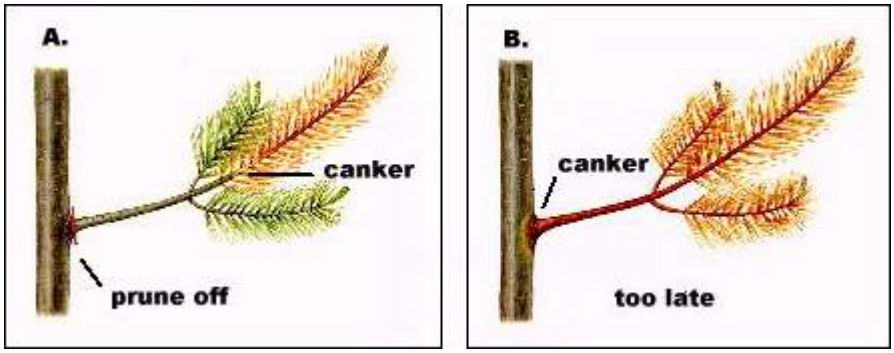
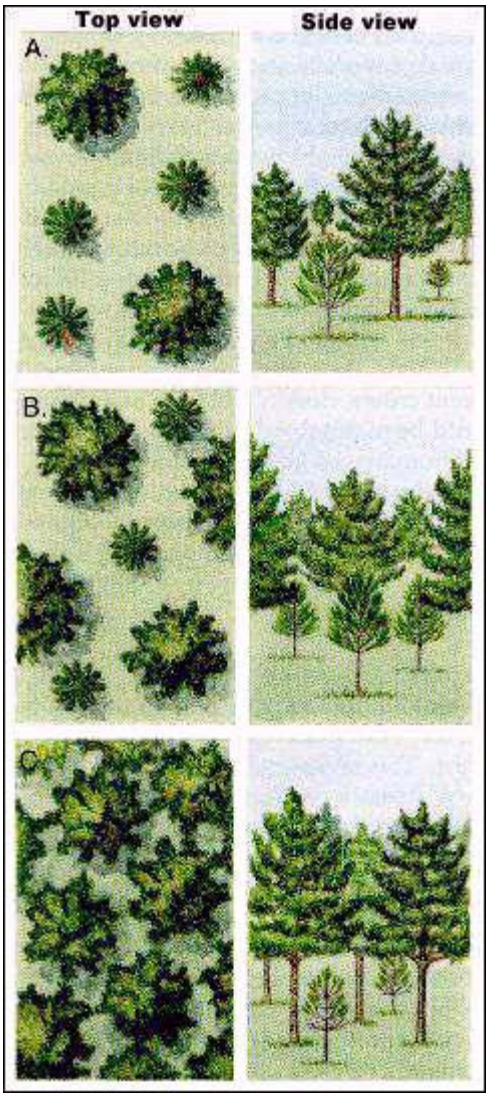


Figure 8. Branches with blister rust cankers further than 4 inches from the main stem should be removed (A), no matter where the branch is in the tree crown. If the canker is within 4 inches of the main stem (B) then pruning will not stop the disease.

White Pine Weevil



The best silvicultural practice to reduce damage from the white pine weevil is to manage young white pine under an existing overstory. (Note that this is the same as blister rust). Shade is detrimental to the survival of weevils, it cools the environment and slows diameter growth of the terminals. Adult weevils tend to avoid laying eggs on shaded white pine with small diameter terminals.

However, heavy shade can be detrimental to white pine growth. There must be a balance between sufficient shade to reduce weevil injury and enough light to maintain adequate tree growth. **As a goal, approximately 40-50 percent crown closure of the overstory trees should be maintained** (illustrated in figure 9). Most unmanaged stands have a natural crown closure of 70-80 percent. Another rule-of-thumb is that 8-15 year old white pine should be growing a minimum of 15 inches in height per year, if growing less, they probably require more light.

A second important silvicultural practice is to maintain high densities of young white pine until the trees reach about 20 feet in height. This is especially important in open-grown plantations. A minimum of 800 trees/acre (7 X 8 ft. spacing) should be planted, although 1200 per acre (6 x 6 ft. spacing) would be preferable. Density creates competition, it forces rapid height growth with minimal terminal diameter growth. Competition also forces laterals on weevil attacked trees to "straighten" quickly. In addition, it causes natural lower branch mortality which augments pruning for rust control. This practice may require pre-commercial thinning of plantations when trees reach 20-24 feet in height.

A cultural practice which will help, is to do corrective pruning following weevil attacks (illustrated in figure 10). Corrective pruning can be done at anytime, but the best time would be mid-July to mid-August when weevils are present in the killed terminals. Pruning and destruction of the dead terminals at this time not only helps correct the injury but may reduce the local weevil population for the following year. Pruned terminals should be destroyed or removed from the site.

Figure 9. Illustration of approximately 25, 50 and 75 percent crown closure. Young white pine should be grown under an over-story of approximately 40-50 percent crown closure. This will provide enough shade to discourage weevils and reduce blister rust infection, but allow in enough light for adequate growth. Most unmanaged natural stands have 70-80 percent crown closure.

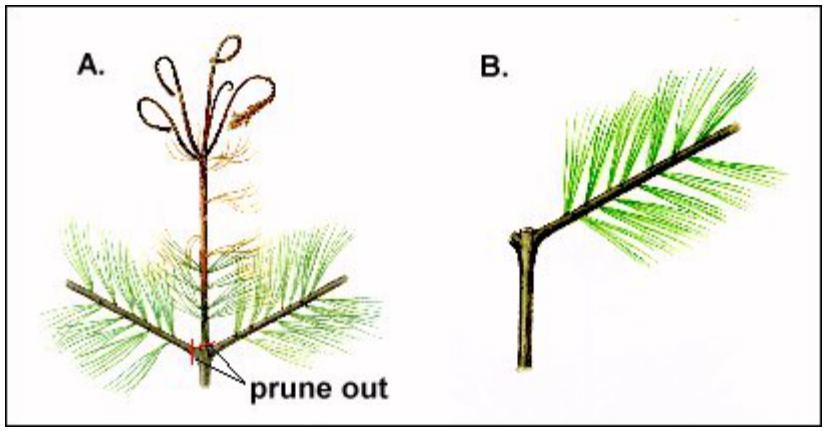


Figure 10. Corrective pruning following a weevil attack should remove the dead terminal and all laterals except one. This lateral will straighten over a period of a few years.

Forest Management Recommendations

Established Understory White Pine Regeneration

1. Release understory white pine by partially removing the overstory, attempt to create conditions that come close to 40-50 percent crown closure (figure 9).

2. Stands greater than 8 years old which are not growing at least 15 inches in height per year could benefit from partial overstory release. Release can be accomplished by felling or girdling overstory trees.

3. Maintain overhead shading until the white pine regeneration is 20 ft. tall or any time terminals are beginning to make contact with branches in the overstory.

4. Prune all crop trees as suggested under Pruning Recommendations (figure 7).

Established White Pine Plantations

1. Selectively remove those trees with unprunable rust cankers and trees with multiple stems or multiple weevil attacks (3 or more attacks/tree). Retain trees which are free of blister rust and weevil attack. Discourage row thinning practices in white pine plantations.

2. Consider precommercial thinning of stands 18-25 years of age to remove any dominant white pine heavily attacked by weevils. This practice will prevent smaller, unattacked trees from becoming suppressed. Weevils often concentrate attacks on the biggest trees in a stand.

3. Prune all crop trees as suggested under Pruning Recommendations (figure 7).

Establishing New White Pine Plantations

1. Evaluate the local blister rust hazard of the planting site **before** planting white pine. Consider a species other than white pine if the planting site is located at the base of a slope, or in a low area or frost pocket, or if the area has a high density of *Ribes* (gooseberries) since this is the alternate host of the fungus which causes blister rust. If you have trouble with this step contact a state DNR forest pathologist or entomologist for advice.

2. Avoid planting in small openings which are defined as, openings with a diameter less than the height of surrounding trees.

3. Plant white pine seedlings at high densities, 6 x 6 ft. spacing is preferable.

4. Plant white pine under an existing forest canopy whenever possible. Even when planting under a tree canopy, plant at as high a density as feasible.

5. Begin following the Pruning Recomendations (figure 7) when trees reach 5-7 years of age.

6. When weevil attacks are first noticed, probably at about age 6 to 10, begin corrective pruning (figure 10). If possible, remove and destroy newly killed terminals in late July or early August before weevils have abandoned them.

Further References

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